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INFORMATION REPORT

REPORT

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COUNTRY East Germany

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SUBJECT The Development of Aluminum-Wound Electric Motors and Generators at VEM Elektromotorenfabrik Wernigerode VEB

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PLACE ACQUIRED

SUPPLEMENT TO REPORT NO.

THIS IS UNEVALUATED INFORMATION

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1. The VEM Elektromotorenfabrik Wernigerode VEB has been experimenting with electric motors with aluminum windings since the beginning of 1951. It is now reported that these experiments have been successful and that motors have been constructed, which in performance are equal to, and in weight less than, normal copper-wound motors of similar output.

2. One of the developments largely responsible for this success is said to be a new lacquer, known as "Iso-Perlon" lacquer. This is alleged to adhere very well to aluminum (in contrast with other previously known lacquers), and, in addition, to be very hard. Its other main characteristics are:

a. Ductility : a wire lacquered with this material can be stretched up to 50% without causing damage to the lacquer film.

b. Flexibility : a wire can be bent through a radius equal to its own diameter without causing the cracking of the lacquer.

c. Compressibility : two lacquered wires can be twisted together and hammered until their diameters are halved, but the breakdown voltage of the lacquer remains over 1500 V.

d. Insulation qualities : a film only 0.04 to 0.06 mm thick of this lacquer suffices to give the necessary insulation. This, being much less than the thickness (0.2 to 0.3 mm) of spun fiber insulation, permits the use of heavier gauge wire and thus compensates for the lower conductivity of aluminum.

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e. Heat resistance : the lacquer gives satisfactory service at temperatures up to 80°C.

Aluminum wire coated with this lacquer was developed by the Walzwerk fuer Buntmetalle, Hettstedt, Harz.

3. It is claimed that difficulties hitherto experienced in the soldering and welding of aluminum have been overcome partly by the development of new welding techniques and partly by the use, at copper-aluminum contacts, of a copper-coated aluminum wire known as "Alku" wire. This wire also avoids the electrolytic corrosion which otherwise occurs when aluminum is in contact with copper or brass in damp air.

4. Operational tests of aluminum-wound motors have been conducted over the past year, including on-off tests lasting two months on unprotected motors in a tropical chamber at an air temperature of 50°C and a relative humidity of 95%. There were no breakdowns of insulation and no corrosion or resistance increases at the switch or terminal connections. Experience had shown that in motors using normal oil-lacquer insulations, short circuits occurred in the windings of 25% of the machines produced. When the new lacquer was used this figure fell to virtually zero.

5. Comparative data given for typical 44 KW copper-wound and aluminum-wound motors are as follows:

Winding	Power factor	Efficiency	Temperature rise
Cu	0.897	89.5%	50.3° C
Al	0.890	89.4%	68.1° C

6. At a meeting of the Fachunterkommission I (research and development) of the Fachkommission I (electric machines) of the Ministry of General and Electrical Engineering (sic) held at the VEM Anlagenbau, Leipzig, on 10 June 1952, the commission reported as follows concerning the practicability of an early conversion from copper to aluminum windings throughout the field of motor and generator construction:

a. Synchronous AC motors, 0.25 to 250 KW (sizes 07 to 19), up to 500 V., open or partly or fully enclosed, for normal use

The use of aluminum windings was declared possible for all stator windings (irrespective of the number of poles) and for the following types of rotor windings:

(1). Cast cage windings for motors up to 63 KW (size 13)
(2). Welded cage windings
(3). Round wire windings (Runddrahtwicklungen)

As regards an early conversion to aluminum windings, however, the following considerations had to be borne in mind:

(1). It was assumed that only round wire windings could be used; that neutral aluminum flux and welding equipment were available; and that "Alku" wire and steel spring rings were available for the terminal connections and terminals.

(2). Individual factories varied greatly in their readiness for an immediate changeover. None of the plants represented at the conference possessed pressure or centrifugal casting gear for machines of between 25 and 63 KW, but it was stated that the VEB Elektromotorenwerk Wernigerode should be in possession of equipment for producing machines up to 44 KW by 31 July 1952. Neither the Elbtalwerk, Heidenau, nor the VEM factories at Gera, Gruenhain, Plauen, or Oschersleben were in a position to produce any cast cage rotors at all.

b. AC generators up to 500 V and 250 KVA (n = 1500), open or enclosed

Conversion to aluminum windings was said to be possible for the strator windings of internal pole machines; for the rotor windings of external pole machines; and for field windings (Polwicklungen). Possibilities of an early conversion were subject to the same limitations as those mentioned in paragraph 6 (a) above.

c. DC generators up to 500 V and 250 KW (n = 1500), open, or partly or fully enclosed

Conversion was said to be practicable for commutator windings (Wendepolwicklungen) for field windings, and for armature windings. The limitations referred to above also applied. The representative of the firm of Fimag, Finsterwalde, was reported to have stated that the method of welding the winding to the commutator which had proved so satisfactory in his factory over many years could be adopted in all factories; the supersonic soldering-irons[1] involved could be relied on to give good results and did not require the use of highly skilled operators.

1. [redacted] Comment. The German term, Ultraschall-Loetgeraete, possibly means induction soldering equipment. 50X1-HUM